

A NEW REPORT OF *CEPHRENES ACALLE* HOPFFER (LEPIDOPTERA: HESPERIIDAE)
FROM SOUTHERN WESTERN GHATS, WITH NOTES ON ITS NATURAL HISTORY
AND IMMATURE STAGES

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The Plain Palm Dart *Cephrenes acalle* Hopffer 1874, which is presently known to occur in India from Bengal to Sikkim, Assam and Andaman & Nicobar Islands, is now recorded for the first time from Thiruvananthapuram in Kerala, peninsular India. This is a significant range extension for this species. A detailed description of the early stages and a note on the natural history of the *C. acalle* is presented. *Cocos nucifera* L. Coconut tree is the host plant for the species in the study area, which enables the species to establish substantial populations. Our observations show that the species is not rare in this region and it was earlier either mistaken for *Telicota ancilla bambusae* Moore or *Telicota colon colon* Fabricius which it resembles, or the species might have eluded early naturalists because of its canopy dependent mode of life. Intensive field surveys in the southern Western Ghats and the Eastern Ghats will help to delineate its exact distributional range and status in peninsular India.

Key words: larval ecology, distributional ranges, range extension, Plain Palmdart, *Cephrenes acalle*, Hesperidae, Lepidoptera, Western Ghats, Kerala, India

INTRODUCTION

The genus *Cephrenes* is primarily concentrated in the Southeast Asia-Papuan region and Australia with only one species *Cephrenes acalle* Hopffer penetrating into the Indian region. Bell (1910) and Evans (1932) referred to the Indian taxon as *Cephrenes palmarum*, which is, according to Evans (1949), a synonym of *Cephrenes chrysozona oceanica* (Mabille 1904). However, its currently valid taxonomic placement following Corbet *et al.* (1992) is *Cephrenes acalle* Hopffer 1874, and the Indian subspecies is thus *Cephrenes acalle oceanica* (Mabille 1904).

The known distributional range of *Cephrenes acalle* is from West Bengal eastward to Myanmar and parts of Indo-China, and in the Andaman & Nicobar Islands (Bell 1910; Evans 1932). The present report from Thiruvananthapuram, Kerala, India, is a range extension for this species by at least 2,500 km. With this addition the currently known Western Ghats butterfly fauna of 333 species (Kunte 2007) now includes 334 species.

Natural history and field notes on the species

We could not find any published descriptions of the natural history of this species or its early stages. Swinhoe (1913) states that larvae of *Cephrenes* had been reared in Calcutta (now Kolkata) in 1900, but Bell (1910) mentioned that the pictures of the larvae Swinhoe mentioned were never found. Thus, our report is probably the first detailed description of the early stages of *Cephrenes acalle* Hopffer 1874.

Our first sighting of the Plain Palmdart was in

December 2006 in the suburbs of Thiruvananthapuram city; a female butterfly was spotted resting on a coconut frond. We photographed the species and confirmed its identity later. Subsequently, four males and four females were seen in the same yard again in December 2006, and in January 2007. Besides collecting samples we observed eight males and four females over a period of two weeks. The fact that all the observed individuals had eclosed recently prompted us to search for caterpillars of the species. Caterpillars were first collected from Thiruvananthapuram in December 2006; some parasitized caterpillars were observed on a coconut tree at Coyalmannam at Palakkad district a few hundred kilometres north of Thiruvananthapuram. Intensive searches at Thiruvananthapuram resulted in the discovery of four caterpillars on a coconut tree 7 m high, from which two male and two female butterflies emerged.

Males of *Cephrenes* look like males of *Telicota*, but the former lacks the characteristic stigma (sex brand) present on the forewings of the latter. Females have narrower, much reduced markings on the upperside and the underside is a dull pinkish-brown rather than orange. Larvae of *Telicota* feed on bamboos and grasses, while *Cephrenes* feeds on palms, including Coconut Palm (Robinson *et al.* 2001). The unusual record by Maxwell-Leffroy and Howlett of *Cephrenes acalle oceanica* feeding on tamarind *Tamarindus indica* (Robinson *et al.* 2001) is probably an error.

Our observations indicate that both the sexes are fond of basking in the sun during mornings, and both visit Coconut Palm flowers exclusively, which were in bloom at the time. As the day advanced, females retired to the undersides or

shaded areas of the coconut fronds, whereas males stayed at vantage points from which they chased other butterflies of their size. Both the sexes were wary but returned back to their former resting places even when disturbed. Flight was extremely powerful and fast, and the species was always found flying high in the canopy. Representative specimens of both the sexes are available in our collection.

METHODOLOGY

The adult butterflies were observed from a fixed point for four hours each in the morning and evening, from 0600 hrs to 1000 hrs, and 1400 hrs to 1800 hrs (Table 1). Adults within a radius of 15 m from this point were included in the analysis; this area included the canopy of eight coconut trees.

The larvae were collected from field and reared under laboratory conditions from January to August 2006. A total of four larvae were reared from first to final instar (Table 1); detailed notes on the larvae, pupae and adult butterflies which emerged were recorded.

The preferred larval host plant was *Cocos nucifera* Coconut palm. It is probable that they feed on other palms too.

Caterpillars collected were reared in plastic containers suitable for their size, for example, a 3 cm long caterpillar was kept in a container 9 cm x 6 cm x 6 cm. Holes of 1mm x 1mm per sq. cm were provided for sufficient aeration and maintaining appropriate humidity. The container was cleaned and fresh leaves were added every day. Measurements were made using Vernier callipers. Morphological descriptions of the larvae follow Bell (1910).

The stage before the first moult has been called newly hatched larva. The area between the sub-dorsal and dorso-lateral aspects of the larvae is described here as the paradorsal region. The adult butterflies reared were released into their natural habitats after photographing them.

Egg

The structure of the egg is not known. It is laid on the under side of the Coconut tree leaflets towards the middle or at the tips as observed on many occasions from remnants of egg shells near the larval cells.

Newly hatched larva

The head capsule is shaped similar to *Telicota* and is shiny black. This stage is characterized by the presence of a chitinous black neck collar on the dorsal half of the neck region. The neck is narrow and the body is widest in the middle, thereafter, it gradually tapers towards the anal end. The body lacks hairs on viewing with naked eyes. The semi-transparent anal plate has a series of long, up-curved and occasionally down curved whitish hairs at its tip. The colour of the body is light honey yellow with a waxy appearance (Fig. 1a).

As soon as the larva emerges from the egg it makes a cell at the tip of the coconut leaflet by joining together the leaf margins with silk strands. This cell is different from other palm feeding Hesperiid's like *Suastus*, but resembles that of *Caltoris*. In cases when the egg is laid at the tip of the leaf the larva makes a large cell by joining two overlapping leaflets with silk. The unusually strong silk strands are placed almost equidistant from each other. They feed a little away from the cell, proximally to it on one side of the margin. The eating pattern is characteristic; the larvae start at the leaf margin working almost perpendicular to the long axis reaching the central vein, thereafter, they eat the soft part between the central vein and outer margin leaving the relatively thick margin untouched (Fig. 1b). The approximate duration of moulting phase to the next instar was about 18 to 24 hours. For larval measurements refer Table 2.

First Instar

The head is roughly triangular in shape with the vertex moderately grooved. Body is long, tubular and hairless except

Table 1: Adult butterfly sightings and breeding data of *Cephrenes acalle* Hopffer 1874 (December 2006 to November 2007)

Month and year	Adult sightings N=29 (19 Males, 10 females)	Larvae observed N=8 (2 males, 5 females, one undetermined)	Remarks
December 2006	Eight males and five females	One female in 3 rd instar	Preyed upon by spider
January 2007	One mating pair and a male	One male	Final instar
February 2007	none	One male	Final instar
March 2007	One male	One 4 th instar, unsexed	Parasitized by wasps
April 2007	none	none	none
May 2007	One male	none	none
June 2007	One male	none	none
July 2007	Two males	none	none
Aug 2007	Two males and two females	Newly hatched larva, 2 nd , 4 th , last instar	All successfully reared
September 2007	One female	none	none
October 2007	Two males	none	none
November 2007	One female	none	none

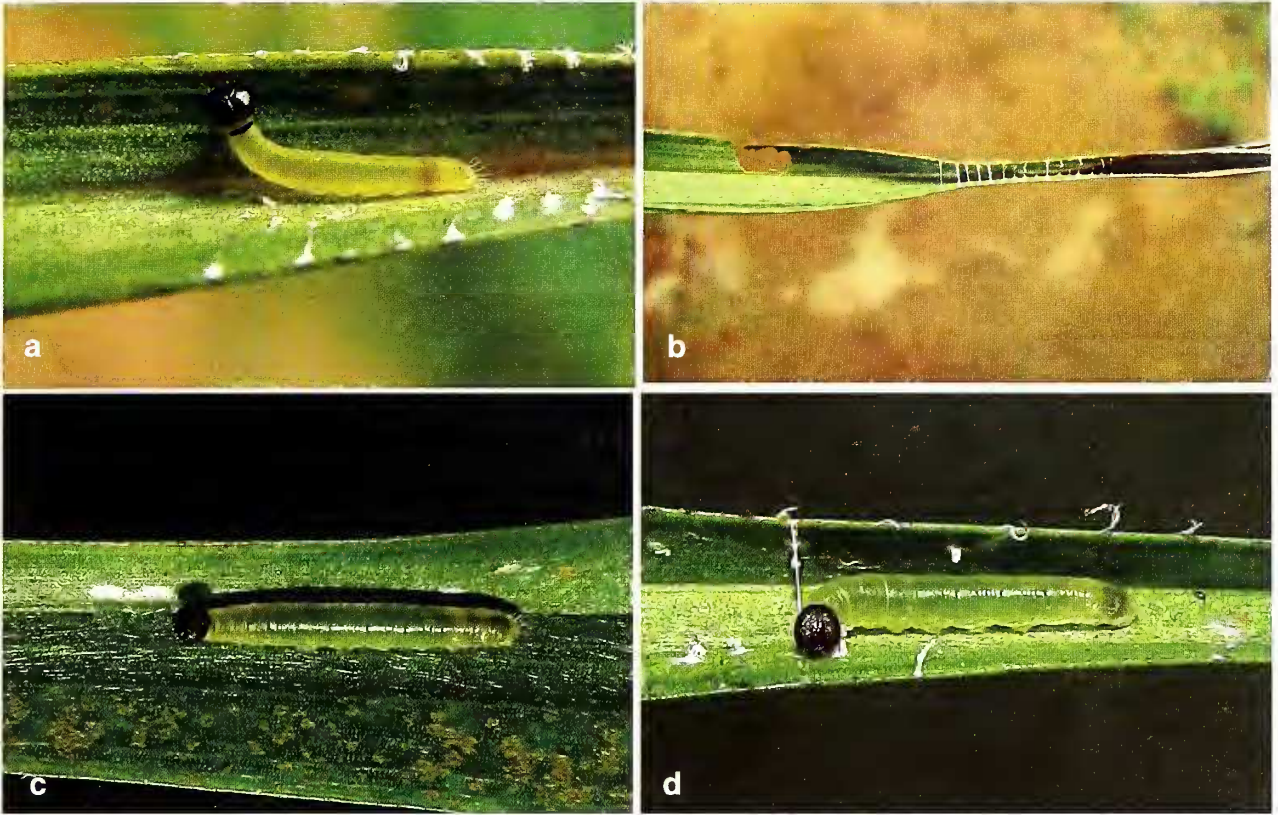


Fig. 1: *Cephrenes acalle* Hopffer 1874 (a-d): a. Newly hatched larva; b. Newly hatched larva cell; c. First instar larva; d. Second instar larva

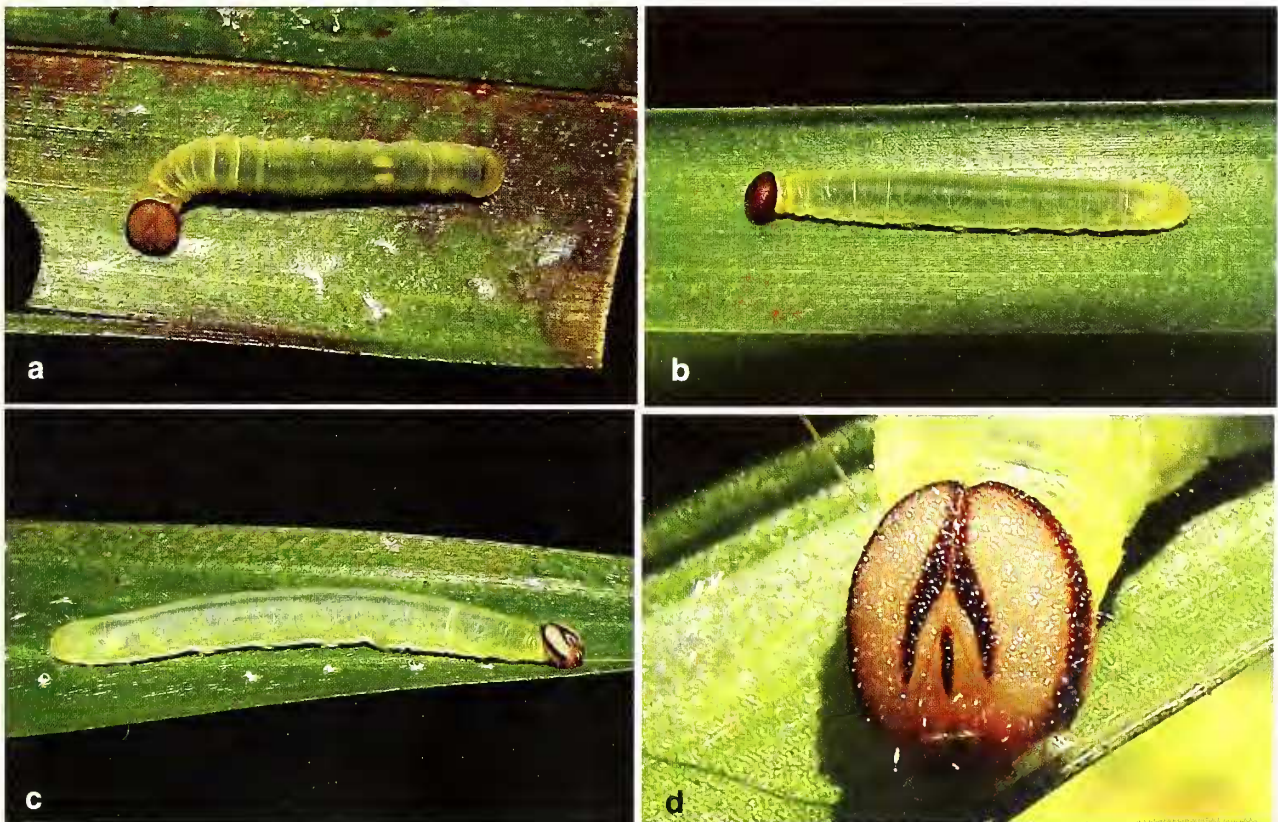


Fig. 2: *Cephrenes acalle* Hopffer 1874(a-c): a. Third instar larva; b. Fourth instar larva; c. Final instar; d. Larval head

at the tip of the anal plate, which is conspicuous. Head capsule dark brown, body dull sap green (Fig. 1c), skin light honey yellow. The segment just before the anal plate appears greyish because of the internal contents, which are visible through the translucent body. Hairs on the anal plate are translucent.

The cell construction and general behavioural patterns are similar in all the instars. When disturbed they bang the anterior thirds of the body and head on the walls of the cell. The floor of the cell is coated with thick silk. The eating is usually confined to one margin of the distal aspect of the leaflet progressing proximally towards the cell. They sometimes make cells with two leaflets; in which case they usually eat the upper leaflet sparing the lower one, i.e., feeding on the leaflet that forms the floor of the larval cell.

Second Instar

This larva is similar to the first instar larva in colour and structure (Fig. 1d). The duration of larval stages and measurements are given in Table 2.

Third Instar

Head capsule is almost round with a coarse texture on magnification. Vertex is shallow. Neck is narrow. Body is long and cylindrical. Tail plate is semi-circular with a series of long whitish hair on it, especially at the tip. Ground colour of head is pale pinkish-white with a reddish tint. Eyes black. A lateral facial band starts appearing at this stage. It starts as a brownish red band around the eye region and ascends separating the face from the cheeks. Thereafter, the bands on either side meet at the shallow vertex where they become somewhat paler and descend through the vertical groove to reach the apex of the false clypeus where it ends. A single vertical brownish red streak

marks the middle of the true clypeus. Mouth parts are brown. The neck and body is pale sap green (Fig. 2a). The semi-transparent skin is pale yellow. The sides of the body are more yellowish and dorsal pulsating line is less delineated in this stage. Tail plate is waxy yellow at the periphery with a grey tinge at the middle. Each segment bears a pair of tiny dark spots in the paradorsal region. Spiracles are vertically oval and are less coloured compared to the later instars.

Fourth Instar

Head capsule is circular in shape. Vertex is shallow. The head is finely reticulo-rugose on magnification. Neck is narrow and thereafter body gradually widens into a cylinder. The later half is dorso-ventrally flattened like in *Baoris*. Anal plate is semicircular in shape and bears a series of long translucent hair at its end.

The ground colour is pale green and skin is pale lemon yellow. The head capsule is waxy brown. The lateral aspect of the lobe face is separated from the cheeks by a dark brown band whose borders are obscure and faded towards the centre of the lobe face. This band passes towards the vertex and then passes down parallel to the vertical groove and to the sides of the false clypeus where it diverges. The main trunk of this band passes onto the level of lower third of true clypeus. The other part passes infero-laterally and gradually fades and merges with the lateral bands. Eyes are black. The dorsal pulsating line is green. Paradorsal band is opaque greenish. The rest of the lateral surface is greenish yellow (Fig. 2b).

Final Instar

The caterpillar looks similar to *Telicota* and *Baoris*. It resembles *Telicota* and *Baoris* in shape while it resembles

Table 2: Biometric data and duration of early stages of *Cephrenes acalle* Hopffer 1874 from larvae reared in laboratory conditions (December 2006-November 2007)

Stages	Duration in days	Measurements in centimeters (cm)	Remarks
Egg	Unknown	Not Available	Laid singly on dorsum of <i>Cocos nucifera</i> leaflets usually on well exposed leaves.
Newly hatched larvae	Unknown	Body: length 0.28-0.5 cm	Found in its typical cell at leaflet tip.
1st instar	6 days	Head: width 0.1 cm Body: length 0.7-1.0 cm	Early stages closely resemble that of <i>Baoris</i> . Cell near leaf tip, floor of cell smeared with thick mat of strong silk.
2nd instar	5-6 days	Head: width and height 0.12 cm Body: length 0.1-1.75 cm	Similar to the previous instar in all respects.
3rd instar	6-7days	Head: width 0.2 cm Body: length 1.5-3.0 cm	General structure and habits similar to last instar, but testicles more conspicuous. Lobe faces on head capsule pale, lateral bands well-defined. resembles <i>Polytremis</i> early stages.
4th instar	6 days	Head: width 0.25 cm; height 0.25 cm Body: length 3.0-3.5 cm	Head capsule richly marked bands may be inconspicuous in this dark background.
Final instar	7-8 days	Head: width 0.3 cm; height 0.4 cm Body: length 3.5-4.5 cm	Typical larva with the characteristic head patterns, more active than predecessors.
Pupa	8-10 days	length 2.5 cm maximum width 0.6 cm width 0.4 cm at head height 0.55 cm at shoulders	Larger than <i>Telicota</i> pupa but paler and less richly coloured, Tail processes extremely reduced in contrast to <i>Telicota</i> .

Telicota in coloration. Head capsule is vertically oval. Vertex is moderately grooved. On magnification, the head is reticulate-rugose and bears short down-curved translucent hairs. Hair is longest around the mouth parts. Neck region and adjoining segments are the narrowest section of the body. Body is widest in the middle. On cross-section the body is arched dorsally and the ventrum is flat. Body is roughly spindle-shaped and transversely divided by small annuli. On lateral view, the body is highest at about the anterior thirds then gradually tapers and flattens dorso-ventrally towards the anal plate. Each segment has five annuli. In each segment, proceeding in the head to tail direction, the first was the largest annuli, the second annulus is incomplete and the rest were complete annuli. The second annulus has a silver spot in the paradorsal region. This spot is not very clearly appreciated in some segments and is not as conspicuous as in *Baoris*. The body has extremely small hairs, which are visible only when held against light and on simple magnification with a hand lens. The tip of anal plate has the longest hair on it which is visible with the naked eye. Spiracles are vertically oval and more or less flushed with the surface. A dark spot is seen near the antero-superior aspect of the spiracle. Another similar spot is observed postero-inferiorly. The male larvae can be differentiated based on the presence of the paired yellowish orange genital organs, which are visible lying beside the dorsal pulsating line in the later third of the body (Fig. 2c).

The ground colour of the larva is pale greenish. The skin is pale lemon yellow, which is more evident at the skin folds near neck and the paraspiracular regions. The head is waxy pale rose brown. The facial lobes and cheeks are separated by a dark black brown band that begins around the eyes; it then passes through the sides of the lobe, face reaching the vertex. From there the band on each side descends parallel to the vertical groove and gradually widens till it reaches the apex of the false clypeus. Thereafter, the bands taper gradually and do not pass beyond the dorsal half of the true clypeus. Another vertical line of similar colour is observed inside the true clypeus. It starts at the apex of the true clypeus and extends till two thirds of its height. Eyes are almost black (Fig. 2d). The dorsal pulsating line is green. The paradorsal bands are opaque, pale white green. The spiracles are lemon yellow in colour.

The cell is made by joining together the two ends of the leaflet making a flattened cell at the leaf tip. Then it eats from the leaf tip advancing proximally leaving the central woody vein. Feeding usually takes place in the dark hours, but they will feed even during the daytime if not disturbed.

Pupation

The larva settles inside the last residing cell for pupation. Its colour changes to yellowish white. The whole

cell is smeared with whitish cereous excretion, which serves as protection against moisture and rain. The amount of this cereous secretion is more than that observed in *Telicota* pupae. The larvae lie motionless and this posture is continued for about 24 hours; the whole process of pupation is completed within this time.

The general structure resembles that of the *Telicota* and *Thoressa-Halpe* group. The pupa is larger in dimensions, but paler in coloration in comparison with *Telicota*. There are no body bands or any cremasteric adhesions (Fig. 3a).

On dorsal view the head is finely curved on front. The snout is absent but the region is marked with a single dark spot. There are some tufts of long hairs around the snout and eyes. The stigma present postero-superior to the eyes is reniform in shape. The body is widest at the origin of wings. Thereafter, the width is constant till about the last quarter, but tapers off rapidly to end in the highly rudimentary tail process. On lateral view the highest point is the hump of the thorax, which is convex; this is followed by a moderate abdomino-thoracic constriction (Fig. 3b). The rest of the body is of a smoother convex contour, which rapidly tapers off from the rear thirds to end in the tail process. On the ventral view, the proboscis is much longer than the rest of *Telicota* and extends to surpass more than half of the second segment distal to the wing cases. It extends for 2 mm when measured from the tips of wing cases (Fig. 3c). In contrast to *Cephrenes*, both species of *Telicota* have short proboscis and it never extends beyond the first intersegmental space distal to the wing cases. The tail process is a short and straight extension from the rear, these are irregular and much reduced in comparison to *Telicota* (Fig. 3d). In *Telicota* the tail process is almost a trapezoid one with a terminal series of uniformly long down-curved hooklets. The whole body is clothed in evenly distributed sparse, moderately long, reddish brown hairs which are more numerous near the rear and front segments.

The general colour of the pupa is pale yellowish white while in contrast the pupae of *Telicota* are much more deeply coloured in brownish yellow with an orangish tint. Head is waxy brownish yellow. The stigma on either sides of the eye rudiments are dark brown. Thorax is coloured pale waxy honey yellow with a greenish tinge. Abdomen is whitish yellow. The spiracles are translucent pale brownish. The tail processes are reddish brown. Duration of pupal stage is about 10 days. The adult butterflies usually (Fig. 4) emerge in the morning hours.

Parasitism and predators

One of the larvae was found to be infesting with parasitoid wasps. Larval infections are rare. Jumping spiders were observed as predators of larvae and adults in the field. Adults also fall prey to Red ants *Oecophylla smaragdina*.



Fig. 3: *Cephrenes acalle* Hopffer 1874(a-d): a. Pupa dorsum; b. Pupa lateral view; c. Pupa ventrum; d. Tail

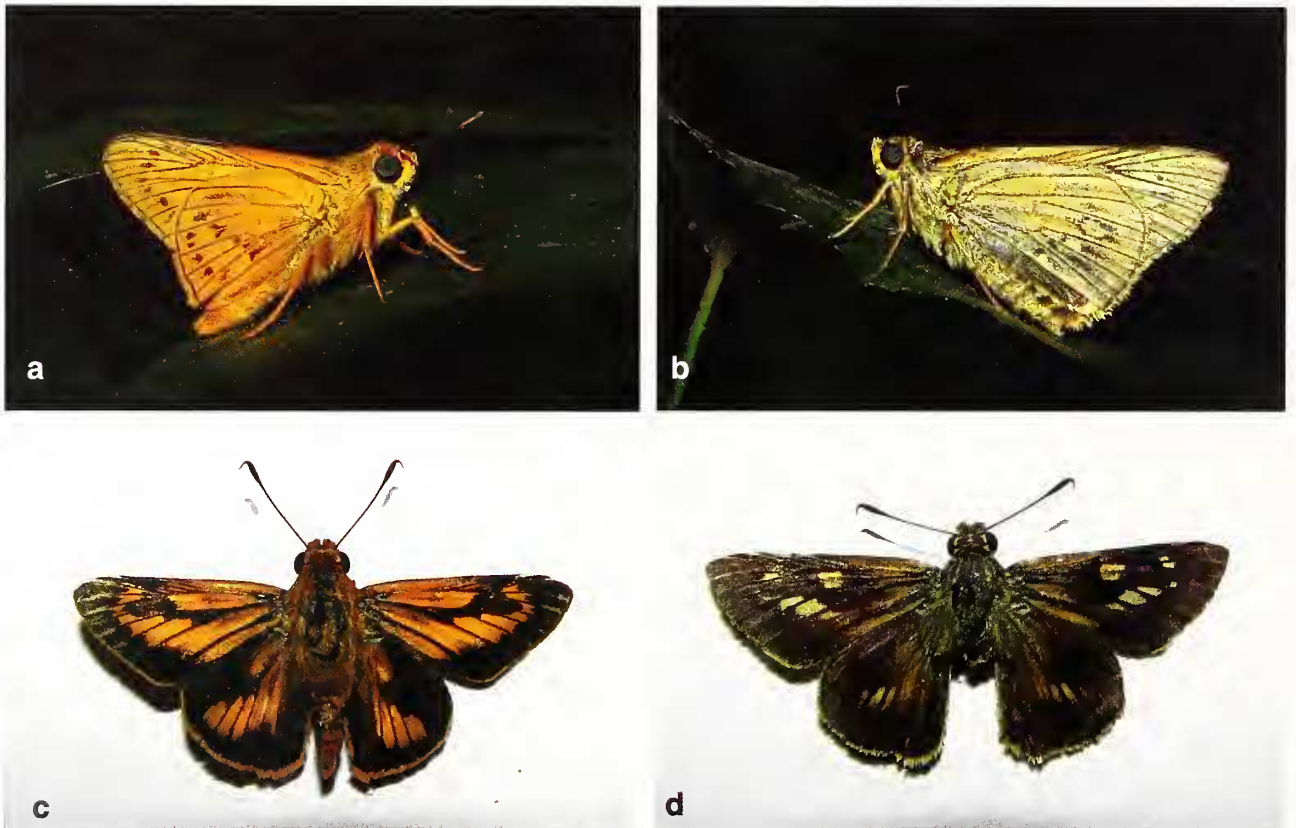


Fig. 4: *Cephrenes acalle* Hopffer 1874(a-d): a. Male underside; b. Female underside; c. Male upperside; d. Female upperside

CONCLUSION

We have presented here the first detailed descriptions of the early stages of the *Cephenes acalle* Hopffer, and reported for the first time the presence of the species in southern India. In this study, it was found that adults were not uncommon in southern Kerala where its larval host plant is available, but was described rare owing to its peculiar habit of keeping to high canopies of coconut trees. Previous works (Fergusson 1891; Kunhikrishnan 2002) on Lepidopteran fauna focussed on this region of the peninsula might have overlooked this species for the related *Telicota* genus. Only larval rearing and detailed adult examination would have revealed the differences between them, moreover these works mainly concentrated on the higher elevations of the Western Ghats and the forested interiors of the district where Coconut,

the preferred host plant, is relatively uncommon. Intensive surveys in the northern and central Western Ghats and in the Eastern Ghats will help to delineate its current distributional range and status in peninsular India. Taxonomical and genetic analysis has to be undertaken to confirm the subspecies status of this species.

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